

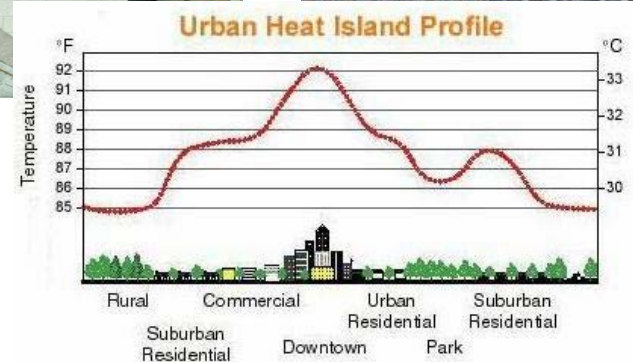
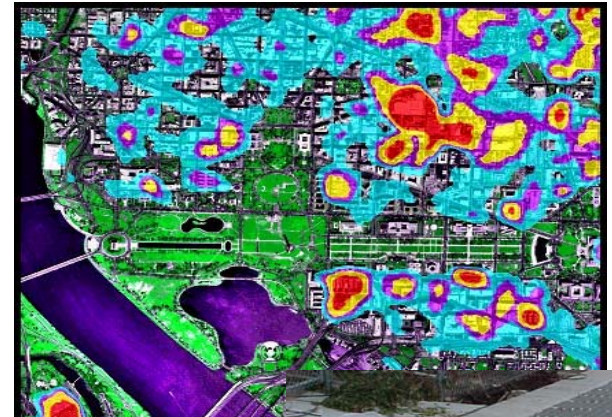
# Urban Heat Islands, Cool Pavements, and Next Steps



**Eva Wong**  
**EPA's Cool Pavement Workshop**  
**June 27, 2005**

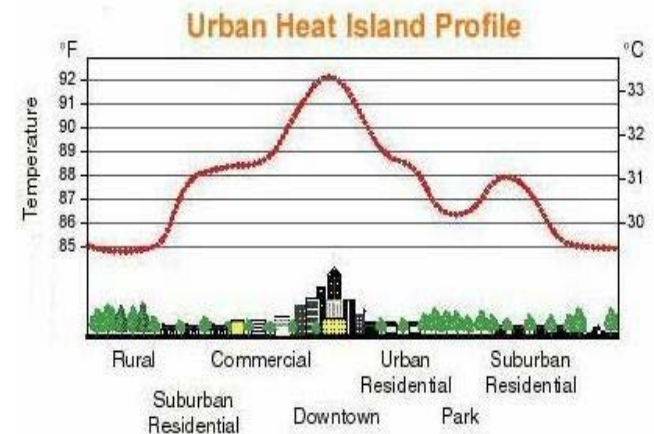
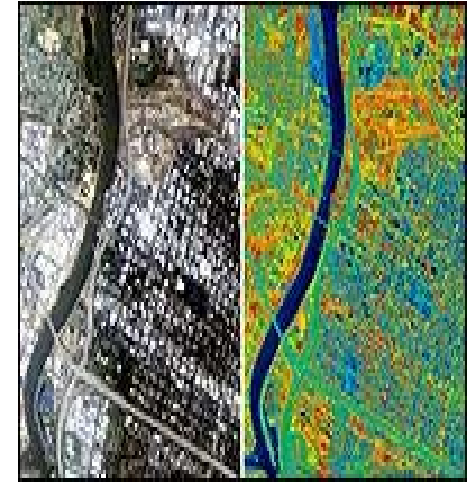
# Presentation Outline

- Workshop Purpose
  - Provide basic understanding
  - Identify gaps and opportunities
  - Develop path forward
- **Heat Island Basics**
- Pavement Basics
- Issues/Gaps
- Next Steps



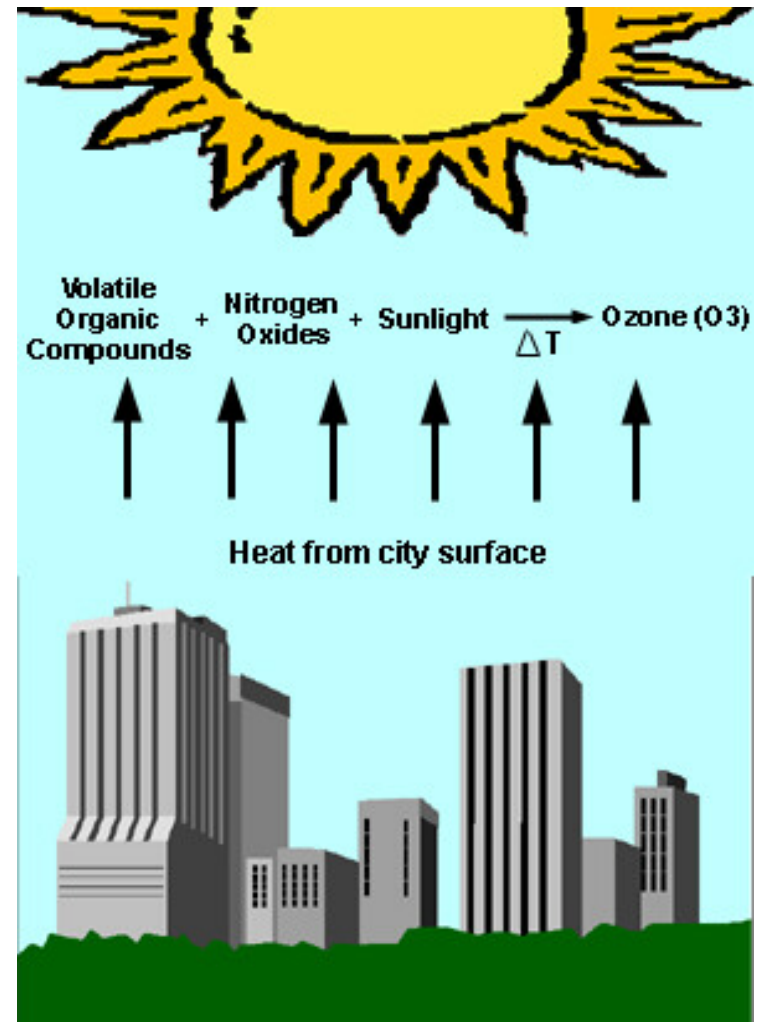
# Heat Island Basics – Definition and Causes

- Heat Island (HI)
  - Elevated Surface and air temps
  - Mainly nighttime phenomenon
  - Main concern often daytime temperatures
- Causes
  - Urbanization
  - Urban Form
  - Anthropogenic



# Heat Island Basics - Impacts

- **Energy Demand - A/C**
  - (LA)  $1^{\circ}\text{F} \uparrow \rightarrow 1.5\text{-}2\% \uparrow$
  - Longer Peaks
- **Air Pollution**
- **GHG Emissions**
- **Ozone Formation**
- **Water Quality**
- **Health**



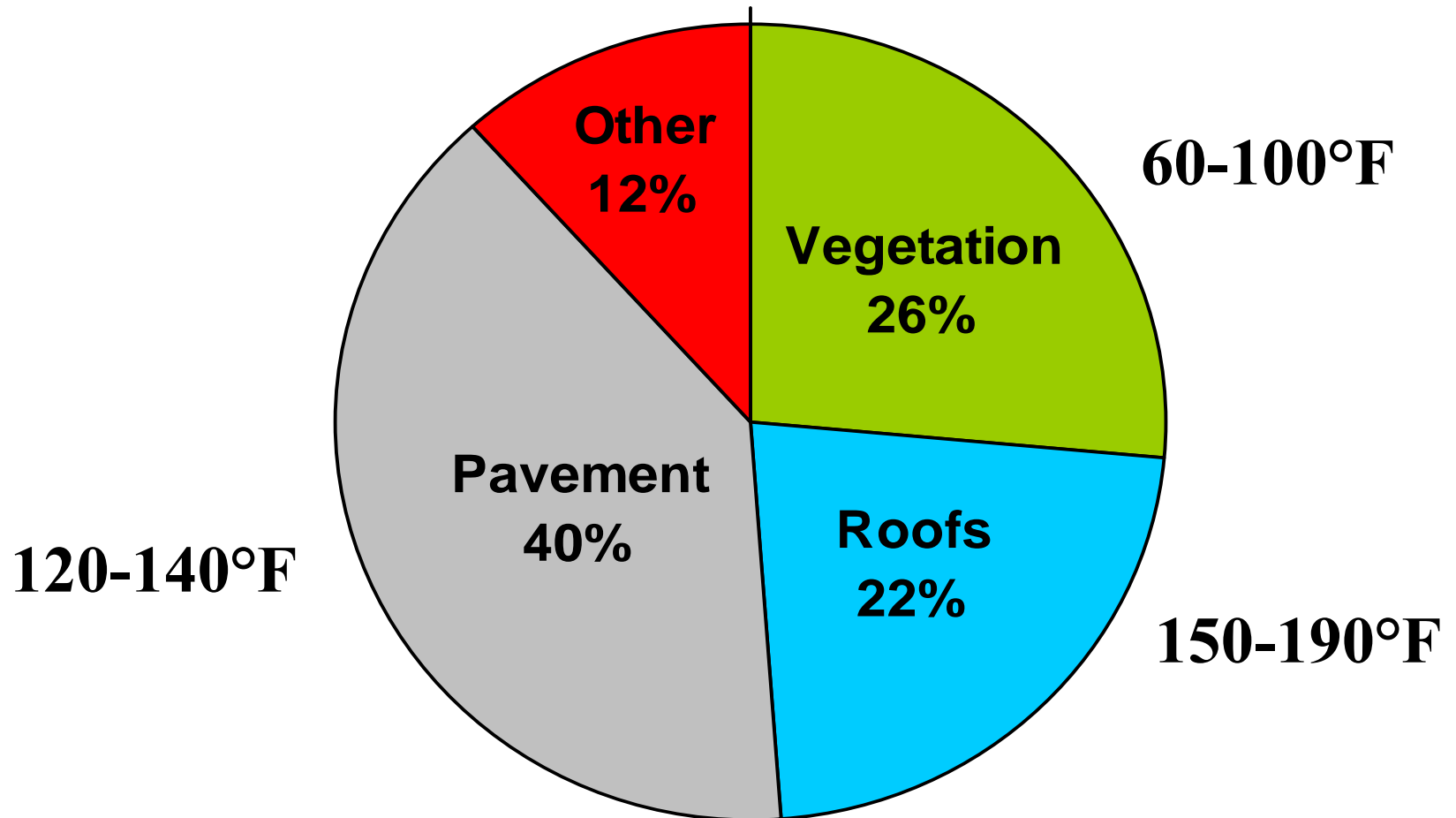
# Heat Island Basics - Strategies to Reduce Heat Islands

- **Urban Vegetation**
- **Cool Roofing**
- **Cool Pavements**



# Heat Island Basics - Strategies to Reduce Heat Islands

**Average Urban Land Cover & Peak Temperatures Ranges**



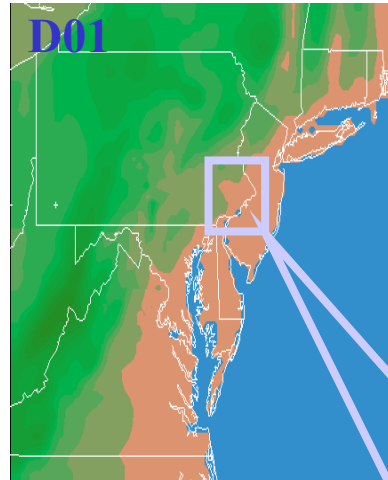


# Heat Island Mitigation – Estimated Benefits

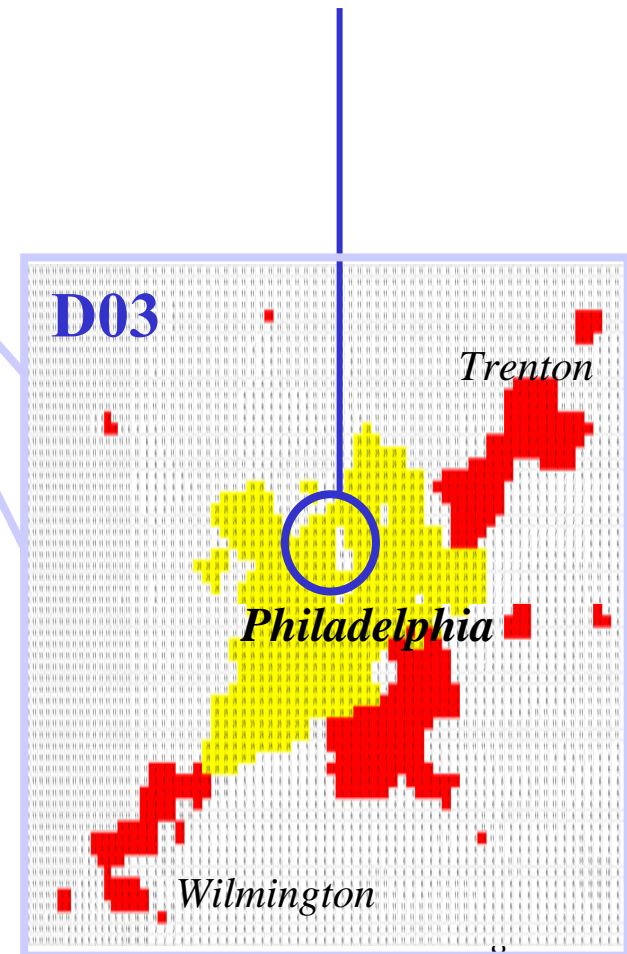
- Energy Demand
  - 10-25% annual energy savings w/all strategies
    - 0.25 albedo ↑ roads, 0.2 albedo ↑ sidewalks
- Air Pollution
  - Benefits from reduced energy demand
  - Vegetation removes pollutants
- GHG Emissions
  - Same as above
  - More considerations – GHG w/manufacturing pavements, etc.
- Ozone Formation - Next slide
- Water Quality – Don Wayne
- Health
  - With all strategies, 0-25% ↓ in heat-related deaths

# Heat Island Basics – Estimated Air Quality Benefits

- Three city study found increasing albedo roofs and pavements and increasing veg  $\approx 3.6^{\circ}\text{F}$  ↓ air temps
- Temp change depends on location, modeling episode, plus other factors
- AQ impacts ranged from modest to 6.5% or 10 ppb ↓ in peak ozone concentrations (Sacramento)
- Ongoing work to improve models
- Results are directionally promising



## North Philadelphia





# Pavement Basics - Urban Fabric

**“Under the Canopy” Percentages of Land Cover Types in Three Metropolitan Areas – Pavements are Mainly Roads and Parking Lots**

	<b>Pavements %</b>	<b>Vegetation %</b>	<b>Roofs %</b>	<b>Other %</b>
Metropolitan Chicago	37	27	25	11
Metropolitan Sacramento	<b>45</b>	20	20	15
Metropolitan Salt Lake City	36	33	22	9
Residential Chicago (53%)	<b>29</b>	36	27	8
Residential Sacramento (49%)	31	33	20	17
Residential Salt Lake City (59%)	32	39	24	6

Source: LBNL fabric analysis reports, figures are rounded.

# Pavement Basics – Relation to HI

- **Pavements Contribute to HI in two ways:**
  - **Solar absorption**
  - **Decreased evaporation due to impervious cover**
- **“Cool Pavement”**
  - **Higher solar reflectance**
  - **Permeability**
    - **Vegetated**
    - ***Porous asphalt and concrete?***



# Pavement Basics - Cool Pavement Benefits

- **Potential Benefits**
  - **Lower surface and air temperatures**
  - **Benefits from reducing HIs (energy, air and water quality)**
  - **Increased nighttime illumination**
  - **Noise reduction**



# Issues We Need to Address

**(1) Who is interested?**

**(2) Why are they interested?**

**(3) What do they need to advance their agenda?**

**(4) Who will participate in this process of moving things forward?**

# Next Steps - Goals

## **Near-term**

- **Develop framework**
- **Identify resources and people to fill gaps**
- **Develop partnerships**
- **Leverage opportunities and future events**
- **Have broad based involvement**

## **Long-term**

- **Develop guidance on pavement options**
- **Potentially work with non-attainment areas**

# Resources

EPA's Heat Island Website [www.epa.gov/heatisland](http://www.epa.gov/heatisland)

The Energy Star Website [www.energystar.gov](http://www.energystar.gov)

EPA's Clean Energy-Environment Work (**New State Partnership!**)  
(<http://www.epa.gov/cleanenergy/stateandlocal/partners.htm>)

Voluntary and Emerging Measures Policy  
<http://www.epa.gov/ttn/oarpg/t1/meta/m8507.html>

International Council for Local Environmental Initiatives (ICLEI)  
[www.hotcities.org](http://www.hotcities.org)